

What is claimed is:

1. A tunable power amplifier, comprising:

at least one input matching circuit receiving an RF signal from an RF input and creating a first output RF signal, said at least one input matching circuit including at least one voltage tunable varactor to enable center frequency tuning;

a first amplifier receiving said first output RF signal from said at least one input matching circuit and creating a second output signal, said second output signal providing input for at least one inter-stage matching circuit, said at least one inter-stage matching circuit creating a third output signal;

a second amplifier receiving said third output signal and creating a fourth output signal;

an output matching circuit receiving said fourth output signal and generating an RF output signal; and

a embedded controller associated with said input matching circuit, inter-stage matching circuit and output matching circuit, for frequency tuning control.

2. The tunable power amplifier of claim 1, further comprising at least one additional inter-stage matching circuit.

3. The tunable power amplifier of claim 1, wherein said at least one inter-stage matching circuit includes at least one tunable varactor to enable center frequency tuning.

5 4. The tunable power amplifier of claim 1, wherein said at least one output matching circuit includes at least one tunable varactor to enable center frequency tuning.

10 5. The tunable power amplifier of claim 2, wherein said at least one additional inter-stage matching circuits is one additional inter-stage matching circuit.

15 6. The tunable power amplifier of claim 2, wherein said at least one additional inter-stage matching circuit is two additional inter-stage matching circuits.

7. A tunable power amplifier, comprising:

a power amplifier with an input RF signal and an first output RF signal;

20 a tuner with at least one tunable varactor, said tuner receiving said first output signal of said power amplifier, and outputting an second RF signal;

a directional coupler for obtaining a sample of said second output RF signal and passing said sample of said second output RF signal to a detector for measuring said sample of said second output signal from said tuner; and

5 a controller to determine if said second output RF signal is a maximum RF signal and, if not, for adjusting a voltage applied to said at least one voltage tunable varactor in said tuner.

8. A tunable power amplifier feedback loop, comprising:

10 a tuner with at least one tunable varactor receiving a first output RF signal obtained from said tunable power amplifier;

a directional coupler for obtaining a sample of a second output signal output from said tuner and passing said sample of said second output RF signal to a detector for measuring said sample of said second output signal from said tuner; and

15 a controller to determine if said second output RF signal is a maximum RF signal and, if not, for adjusting a voltage applied to said at least one voltage tunable varactor in said tuner to modify subsequent outputs from said tuner.

20 9. A tunable RF front end for a mobile handset, comprising:

an antenna with a diplexer for dividing incoming and outgoing signals into high band and a low band signals;

a low pass filter receiving said low band RF signals from, and transmitting said low band RF signals to, said antenna via said diplexer;

a low band duplexer duplexing signals from a transmit side and a receive side, said transmit side comprising at least a first and second tunable filter with at least one power amplifier between said at least first and second tunable filter, said receive side comprising at least a first and second tunable filter with at least one low noise amplifier between said at least first and second tunable filter;

a high pass filter receiving said high band RF signals from and transmitting said high band RF signals to said antenna via said diplexer; and

a high band duplexer duplexing signals from a transmit side and a receive side, said transmit side comprising at least a first and second tunable filter with at least one power amplifier between said at least first and second tunable filter, said receive side comprising at least a first and second tunable filter with at least one low noise amplifier between said at least first and second tunable filter.

10. The tunable RF front end for a mobile handset of claim 9, wherein said tunable power amplifier, comprises:

at least one input matching circuit receiving an RF signal from an RF input and creating a first output RF signal, said at least one input

matching circuit including at least one voltage tunable varactor to enable center frequency tuning;

a first amplifier receiving said first output RF signal from said at least one input matching circuit and creating a second output signal, said second output signal providing input for at least one inter-stage matching circuit, said at least one inter-state matching circuit creating a third output signal;

a second amplifier receiving said third output signal and creating a fourth output signal;

an output matching circuit receiving said fourth output signal and generating an RF output signal; and

an embedded controller associated with said input matching circuit, inter-state matching circuit and output matching circuit for frequency tuning control.

11. The tunable power amplifier of claim 10, further comprising at least one additional inter-stage matching circuit.

12. The tunable power amplifier of claim 10, wherein said at least one inter-stage matching circuit includes at least one tunable varactor to enable center frequency tuning.

13. The tunable power amplifier of claim 10 wherein said at least one output matching circuit includes at least one tunable varactor to enable center frequency tuning.

5 14. The tunable power amplifier of claim 11, wherein said at least one additional inter-stage matching circuits is one additional inter-stage matching circuit.

10 15. The tunable power amplifier of claim 11, wherein said at least one additional inter-stage matching circuits is two additional inter-stage matching circuits.

16. A method of tuning a power amplifier, comprising the steps of:

15 providing at least one input matching circuit receiving an RF signal from an RF input and creating a first output RF signal, said at least one input matching circuit including at least one voltage tunable varactor to enable center frequency tuning;

20 providing a first amplifier receiving said first output RF signal from said at least one input matching circuit and creating a second output signal, said second output signal providing input for at least one inter-stage matching circuit, said at least one inter-stage matching circuit creating a third output signal;

providing a second amplifier receiving said third output signal and creating a fourth output signal;

providing an output matching circuit receiving said fourth output signal and generating an RF output signal; and

5           adjusting the frequency tuning with an embedded controller associated with said input matching circuit, inter-stage matching circuit and output matching circuit.

10           17.    The method claim 16, further providing at least one additional inter-stage matching circuit.

15           18.    The method claim 16, further providing at least one inter-stage matching circuit which includes at least one tunable varactor to enable center frequency tuning.

19.    The method claim 16, further providing at least one output matching circuit which includes at least one tunable varactor to enable center frequency tuning.

20           20.    The method claim 19, wherein the step of further providing at least one additional inter-stage matching circuit is one additional inter-stage matching circuit.

21. The method claim 19, wherein the step of further providing at least one additional inter-stage matching circuit is two additional inter-stage matching circuits.

5 22. A method of impedance matching in a power amplifier, comprising the steps of:

providing a power amplifier with an input RF signal and a first output RF signal;

10 providing a tuner with at least one tunable varactor, said tuner receiving said first output signal of said power amplifier, and outputting a second RF signal;

15 obtaining a sample of said second output RF signal with a directional coupler and passing said sample of said second output RF signal to a detector for measuring said sample of said second output signal from said tuner; and

determining with a controller if said second output RF signal is a maximum RF signal and, if not, adjusting a voltage applied to said at least one voltage tunable varactor in said tuner.